

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-248692

(43)Date of publication of application : 22.09.1997

(51)Int.Cl.

B23K 26/14  
B23K 26/00  
B25H 7/04  
B41M 5/26

(21)Application number : 08-060446

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(22)Date of filing : 18.03.1996

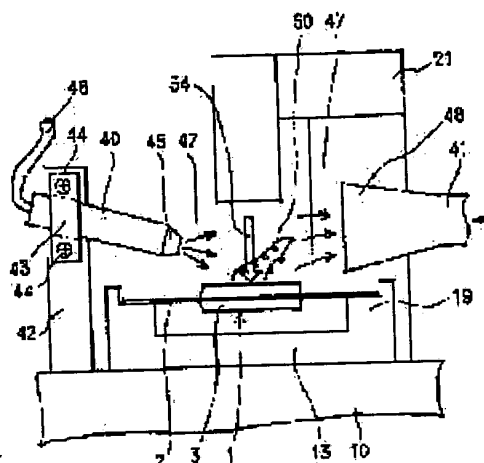
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## (54) LASER MARKING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To enable marking of clear characters or the like by injecting gas and removing smoke generating from a marking area.

SOLUTION: A clean gas 47 (air) is injected from a gas ejecting nozzle 45 to a marking area, thereby instantly removing from the marking area the smoke or soot, etc., (50) generated from the surface of a resin package, an object 3 to be marked by laser marking. Consequently, in printing the next character, interposition is eliminated such as smoke 50 obstructing a laser beam 34, thereby enabling marking by the laser beam 34 with a prescribed light intensity and realizing a clear marking. In addition, the smoke 50 blown off by the gas 47 from the ejecting nozzle 45 is instantly removed from the working space by a ventilator 41; therefore, possibility is eliminated for the gas to enter the marking area again, so that a clear marking is attained.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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## CLAIMS

[Claim(s)]

[Claim 1] The laser mark equipment characterized by to have the gas jet nozzle which is laser mark equipment which a laser beam is made to irradiate alternatively the marking-ed object on the installation base in which a marking-ed object is laid, and the aforementioned installation base, and carries out marking to the front face of a marking-ed object, injects a gas to the smoke generated from the marking-ed object on the aforementioned installation base, and eliminates smoke etc. from a marking field at least.

[Claim 2] Laser mark equipment which a laser beam is made to irradiate alternatively the marking-ed object on the installation base which is characterized by providing the following, and in which a marking-ed object is laid, and the aforementioned installation base, and carries out marking to the front face of a marking-ed object. The gas jet nozzle which injects a gas to the smoke generated from the marking-ed object on the aforementioned installation base, and eliminates smoke etc. from a marking field at least.

The exhaust which attracts the smoke blown away by the aforementioned gas jet nozzle.  
[Claim 3] The aforementioned laser mark equipment is laser mark equipment according to claim 1 or 2 characterized by choosing the font of a mask one by one and having the composition of performing marking on the front face of the aforementioned marking-ed object one by one.

[Claim 4] The aforementioned laser mark equipment is laser mark equipment according to claim 1 or 2 characterized by having composition which scans a laser beam and carries out marking of the direct predetermined character etc. to the front face of the aforementioned marking-ed object.

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## DETAILED DESCRIPTION

### [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention is applied to the technology which carries out marking of a character, the sign, etc. to the package side made of the resin of semiconductor devices, such as IC (integrated circuit device), concerning laser mark equipment, and relates to effective technology.

[0002]

[Description of the Prior Art] The laser marking method is learned as one of the methods of forming a mark in the package side made of the resin of a semiconductor device.

[0003] Marking to a semiconductor package is indicated by P593 -P596 in Ohm-Sha Ltd. issue "TOSHIBA REVIEW" 44 volume 7 No. and 1989, for example. The mask method which carries out marking of the character etc. to a semiconductor package side about the method of laser marking by the laser beam which penetrated the mask, the scanning method which scans the extracted laser beam and carries out marking to a direct semiconductor package side, and the method which carries out raster SUKYA of the mask pattern partially, and performs marking are indicated by this reference.

[0004]

[Problem(s) to be Solved by the Invention] Also in these people, marking is carried out to the package side of a semiconductor device with laser mark equipment. In this case, the font (alphabetic character) which was made to move a mask relatively and was written by the mask is chosen one by one, laser beam irradiation is performed, and marking of the character etc. is carried out to the package side one after another.

[0005] On the other hand, the material which forms the package of a semiconductor device was changed into a resin material new recently from the purpose of the mold release disposition superiors at the time of transfer mold. Although this resin was an epoxy system resin as usual, it was made to perform marking with the high irradiation energy of 1200mJ(s) used as the 1.5 - double-precision grade of the conventional irradiation energy from the ability of marking sufficient with the irradiation energy of about 600-800 mJs currently used conventionally not to be performed.

[0006] however, by the method of attributing irradiation energy size and carrying out marking (printing) of the character one by one, it turns out that the phenomenon in which some characters become indistinct occurs

[0007] For example, the semiconductor device 1 in the middle of manufacture is shown, the package 3 which becomes a part of leadframe 2 from a resin (resin) by transfer mold is

formed, and drawing 6 constitutes the semiconductor device portion from a part. the front face of the aforementioned package 3 -- for example, two trains -- continuing -- "ABC...BE" -- the case where a character string is printed -- the first "A" -- although there was nothing that a character 4 was indistinct with a bird clapper, as shown in drawing 6, in the case of the character 4 which continues after that, it became clear that it may become the defective character 5 in which the part was missing drawing 6 -- "A" -- "B" and "C" following a character 4 -- the defective character 5 in which the upper half was [ the character 4 ] missing -- becoming -- "E" -- "B" before a character 4 -- the character 4 is the defective character 5 in which the lower left end portion was missing

[0008] When this irradiates a laser beam with large irradiation energy at a resin (package 3), A lot of smoke, soot, etc. are generated from irradiation energy being large, and this smoke, soot, etc. drift throughout [ surface absentminded / a package 3 ]. When the following character was printed, the aforementioned smoke, soot, etc. became an obstruction and it was proved that it is what is generated when the irradiation energy of the laser beam irradiated by the front face of a package 3 falls. That is, since optical intensity falls, it is completely interrupted with smoke, soot, etc., the portion which is not printed occurs, or the laser beam of a portion which shone upon the aforementioned smoke, soot, etc. is printed thinly. Defluxion of the character in which the whole printing portion is no longer printed by the size of spreading ranges, such as smoke and soot, and the lack which a part of character lacks occur.

[0009] Since a semiconductor device is manufactured with the work environment which dislikes dust, a work environment (inside of a workroom) is set as a clean state. Since, as for the laser mark work environment, the semiconductor chip is closed with the package, although a high air cleanliness class is unnecessary like the work environment of photolithography, laser mark equipment is also used in a pure environment. For example, laser mark equipment is used, being installed in the clean room by the downflow as indicated by the aforementioned reference.

[0010] Consequently, smoke, soot, etc. which are generated at the time of laser beam irradiation are exhausted one by one by operation of a clean room.

[0011] However, in the case of laser marking which makes irradiation energy high and prints a character one after another, movement, such as smoke and soot, is late, and in case it is printing of the following character, neither smoke nor soot will be able to be completely eliminated [ by ] from a marking field, but the above defective characters will occur in the conventional clean room.

[0012] At the time of laser beam irradiation, the purpose of this invention is to offer the laser mark equipment which can carry out marking of the clear character etc. one by one, even if smoke, soot, etc. are generated so much.

[0013] The other purposes and the new feature will become clear from description and the accompanying drawing of this specification at the aforementioned row of this invention.

[0014]

[Means for Solving the Problem] It will be as follows if the outline of a typical thing is briefly explained among invention indicated in this application.

[0015] (1) It is laser mark equipment which a laser beam is made to irradiate alternatively the marking-ed object on the installation base in which a marking-ed object is laid, and the aforementioned installation base, and carries out marking to the front face of a marking-ed object. It has the exhaust which attracts the smoke blown away by the gas jet nozzle which

injects a gas to smoke, soot, etc. generated from the marking-ed object on the aforementioned installation base, and eliminates smoke, soot, etc. from a marking field at least, and the aforementioned gas jet nozzle, soot, etc. The aforementioned laser mark equipment chooses the front of a mask one by one, and has the composition of performing marking on the front face of the aforementioned marking-ed object one by one. A pure gas is injected from the aforementioned gas jet nozzle. The aforementioned marking-ed object is a semiconductor device, and marking is carried out to the front face of a package which consists of resin.

[0016] (2) In the composition of the aforementioned means (1), the aforementioned laser mark equipment has composition which scans a laser beam and carries out marking of the direct predetermined character etc. to the front face of the aforementioned marking-ed object.

[0017] According to the means of the above (1), in order to turn a pure gas to a marking field and to inject it from a gas jet nozzle, smoke, soot, etc. which were generated from the front face of a resin package by laser marking are eliminated in an instant from a marking field. Therefore, at the time of printing of the following character, from the smoke acting as the obstacle of a laser beam, soot, etc. stopping intervening, marking by the laser beam which has optical predetermined intensity becomes possible, and clear marking is attained. Moreover, clear marking is attained, without entering a marking field again, since smoke, soot, etc. which were blown away by the gas injected from the gas jet nozzle are exhausted from a workspace with the exhaust in an instant.

[0018] According to the means of the above (2), when carrying out marking of the direct predetermined character etc. to the front face of a resin package by the scanning method (picture drawn without lifting the brush from the paper), since the smoke generated from the laser beam irradiation section, soot, etc. are eliminated from a scanning portion by the gas injected from a gas jet nozzle in an instant and are eliminated from a workspace with the exhaust, they can carry out marking of the clear character etc.

[0019]

[Embodiments of the Invention] Hereafter, with reference to a drawing, the form of operation of this invention is explained in detail. In addition, in the complete diagram for explaining the form of implementation of invention, what has the same function attaches the same sign, and explanation of the repeat is omitted.

[0020] Drawing 1 or drawing 3 is drawing concerning the laser mark equipment which is 1 operation form of this invention, and the outline cross section in which drawing 1 shows the marking equipment section, the perspective diagram in which drawing 2 shows the appearance of laser mark equipment, the \*\* type view in which drawing 3 shows the optical system of the marking equipment section, and drawing 4 are the typical plans showing the semiconductor device supported by the leadframe by which marking was carried out with the laser mark equipment of this operation form.

[0021] As the laser mark equipment of this operation form is shown in the external view of drawing 2, loader equipment 11 is arranged at the end (left end) of \*\*\*\* 10, and unloader equipment 12 is arranged at the other end (right end). Moreover, on the aforementioned machine base 10, the guide rail 13 which continues and extends from the aforementioned loader equipment 11 to unloader equipment 12 is arranged. The aforementioned guide rail 13 forms the guide and installation base for transporting or fixing a marking-ed object.

[0022] A marking-ed object is the semiconductor device 1 in the middle of manufacture, and as shown in drawing 1 and drawing 4, it consists of a package 3 which closes the predetermined portions of the thin strip-of-paper-like leadframe 2 and this leadframe 2.

While a semiconductor chip is fixed in the aforementioned package 3, the electrode of this semiconductor chip and the lead 6 are connected with the conductive wire which is not illustrated. A leadframe 2 is supported by the susceptor 19 of a guide rail 13 in the both sides, as shown in drawing 1 .

[0023] With this operation form, marking of the predetermined character string is carried out to the front face of the package 3 of the aforementioned semiconductor device 1 by laser marking.

[0024] The aforementioned loader equipment 11 consists of the frame elevator section 14 which you hold [ section ] the magazine which holds the strip-of-paper-like leadframe 2, and makes it go up and down the aforementioned magazine, and the frame transfer section 15 which holds the unloader equipment 12 of the top in the aforementioned magazine, and is transported on the aforementioned guide rail 13.

[0025] The aforementioned unloader equipment 12 consists of the frame elevator section 17 which you hold [ section ] the magazine which holds the strip-of-paper-like leadframe 2, and makes it go up and down the aforementioned magazine, and the frame transfer section 16 which holds the leadframe 2 on the aforementioned guide rail 13, and is transported one by one into the magazine of the aforementioned frame elevator section 17.

[0026] Moreover, the leadframe 2 attached in the aforementioned guide rail 13 is intermittently transported by the frame delivery section which is not illustrated, and is correctly positioned according to the positioning mechanism arranged in each part at each work station.

[0027] Along with the aforementioned guide rail 13, a dust \*\*\*\* station, a marking station, a \*\*\*\*\* station, and a mark inspection station are prepared towards the unloader equipment 12 side from the loader equipment 11 side, and dust \*\*\*\* equipment 20, marking equipment 21, \*\*\*\*\* equipment 22, and mark test equipment 23 are arranged in each station. Moreover, the control section by the central processing unit (CPU) which controls each aforementioned equipment is arranged in the interior of \*\*\*\* 10.

[0028] Dust \*\*\*\* equipment 20 defecates the front face of a package 3 where marking is performed. That is, the brush made of a resin is rotated, the front face of a package 3 is ground, and it has the structure of removing the dust of the front face of a package 3. Static electricity occurs by friction with a brush and a package, and since there is a possibility of causing product destruction with this static electricity, electricity is discharged by the electric discharge blower. Moreover, dust is removed by the evacuation mechanism.

[0029] Although marking equipment 21 is mentioned later, it performs marking of one character at a time on the front face of a package 3 by laser one by one with a mask method.

[0030] Laser marking prints by considering as off-white burning the resin (black) of the front face of a package 3 by the energy of a laser beam, and considering as a hollow, and by split-face-izing a front face. Consequently, soot is generated by laser beam irradiation. Since this soot is connected also with the malfunction of equipments, such as a sensor, it is necessary it not only to have a bad influence on a human body, but to remove it.

[0031] \*\*\*\*\* equipment 22 serves as the same structure as the aforementioned dust \*\*\*\* equipment 20, the front face of a package 3 is ground against a brush, discharging electricity, and the soot adhering to the front face of a package 3 is removed. Soot is removed by the evacuation mechanism.

[0032] Mark test equipment 23 consists of image processing systems which used the CCD (charge car pool device) camera, and detects the character string (mark) by which marking

was carried out. Marking operation is stopped, when the quality of a mark is judged by the aforementioned control section based on the inspection information by mark test equipment 23 and a defect occurs.

[0033] The optical system of the aforementioned marking equipment 21 has composition like drawing 3. This optical system is notional composition and is constituted by the laser oscillation machine 30, the reflecting mirror 31, the mask 32, and the image formation lens 33. It is reflected with a reflecting mirror 31, and the laser beam 34 by which outgoing radiation was carried out from the laser oscillation machine 30 penetrates a mask 32 and the image formation lens 33, and connects an image to the front face of a package 3. Therefore, the character corresponding to the font of a mask 32 is printable on the front face of a package 3 with a predetermined pulse oscillation.

[0034] The aforementioned mask 32 consists of a glass mask, and fonts (alphabetic character), such as a predetermined character and a sign, are arranged. Moreover, a mask 32 is supported by the position control mechanism 35, and can choose a desired font now in the case of marking. And a character is printed one by one on the front face of a package 3 by switch of this font.

[0035] On the other hand, although this is one of the features of this invention, as shown in drawing 1, the gas jet nozzle 40 and the exhaust 41 are arranged in the marking station. That is, the support 42 is being fixed to \*\*\*\* 10 portion of the unilateral of a guide rail 13. The aforementioned gas jet nozzle 40 is fixed to the unilateral side of this support 42 with the clip band 43. A part for the both ends of the clip band 43 is fixed to a support 42 with a screw 44, respectively. At the time of fixation of this screw 44, in the clip band 43, the gas jet nozzle 40 is bound tight to a support 42, and it fixes. Moreover, the direction of the nozzle 45 of the gas jet nozzle 40 can be set up at the time of this fixation. A gas is injected to a marking field by this setup.

[0036] The supply pipe 46 connected to the compression pump which is not illustrated is connected to the back end of the aforementioned gas jet nozzle 40, and air 47 is injected from the aforementioned nozzle 45. Moreover, a filter is arranged in the predetermined part of a transport system, and always pure air is injected. The air 47 injected from the aforementioned nozzle 45 is injected towards a marking field. Thereby, as shown in drawing 1, 50, such as smoke, soot, etc. which are generated from the front face of a package 3 at the time of marking by the laser beam 34, is eliminated by the injected air 47 from a marking field in an instant.

[0037] On the other hand, the jet pipe 48 of the exhaust 41 is arranged in the side other than the aforementioned guide rail 13 (i.e., the direction where the air 47 by which injection was carried out [ aforementioned ] flows). Although illustration is not carried out to this jet pipe 48, while an exhaust air pump is connected to it, a soot processor etc. is attached, and the air which it defecated is constituted so that it may be emitted into the atmosphere. 50, such as smoke, soot, etc. which dispersed with the air 47 injected from the aforementioned gas jet nozzle 40, is recovered by the exhaust 41 located in the scattering direction.

[0038] With the laser mark equipment of this operation gestalt, the leadframe 2 in which the package 3 was formed by loader equipment 11 is transported on a guide rail 13. A guide-rail 13 top is intermittently transported one by one to the leadframe 2 on a guide rail 13 by the frame delivery section (frame delivery mechanism) which is not illustrated. Moreover, at each station, it is positioned with high precision according to the positioning mechanism which is not illustrated.



[0039] Marking of the front face of the package 3 of the semiconductor device 1 supported by the leadframe 2 is carried out in a desired mark by marking equipment 21 by dust \*\*\*\* equipment 20 defecating at a dust \*\*\*\* station at a marking station, \*\*\*\*\* equipment 22 defecates at a \*\*\*\*\* station, and the judgment of the quality of a mark is made by mark test equipment 23 by the mark inspection station. And marking work is suspended when a mark becomes poor with the aforementioned mark test equipment 23. Marking work is again continued after repair by the operator. The leadframe 2 which went to the edge of a guide rail 13 is held in the magazine for unloaders one by one by unloader equipment 12.

[0040] The laser mark equipment of this operation gestalt performs laser marking at the time of marking in the aforementioned marking station, injecting pure air 47 from the gas jet nozzle 40 to the surface portion, i.e., the marking field, of a package 3. Consequently, printing (marking) which switches the font of a mask 32 since it is eliminated from a marking portion by the air 47 by which 50 [ soot / this smoke ] was injected from the aforementioned gas jet nozzle 40 even if 50 / soot / smoke, ] occurred one by one by laser marking in an instant, and is performed one by one will not be interrupted by 50 / soot / smoke, ], and it can print correctly. Drawing 4 shows the example in which the mark (character string) 7 without defluxion of a character 4 or the chip of a character 4 was printed on the front face of a package 3. A mark 7 covers "ABC...BE" and two steps and is written.

[0041] Since the exhaust 41 which the laser mark equipment of this operation gestalt attracts 50, such as smoke, soot, etc. which rode on the air 47 injected from the aforementioned gas jet nozzle 40, and dispersed, and is exhausted is formed, 50 makes an excursion and neither smoke nor soot drifts in a marking field again. Therefore, marking can be performed in the always good state.

[0042] Since the laser mark equipment of this operation gestalt can be eliminated from a marking field in an instant even if smoke, soot, etc. are generated so much at the time of laser beam irradiation, it can carry out marking of the mark also to the package side by the resin which smoke, soot, etc. tend to generate correctly.

[0043] Although invention made by this invention person above was concretely explained based on the operation gestalt, it cannot be overemphasized by this invention that it can change variously in the range which is not limited to the above-mentioned operation gestalt and does not deviate from the summary.

[0044] For example, this invention is applicable also to the laser mark equipment of a scanning (picture drawn without lifting the brush from the paper) method. Drawing 5 is the \*\* type view showing the optical system of the marking equipment 21 in the laser mark equipment which is other operation gestalten of this invention.

[0045] The optical system of the scanning method shown in drawing 5 is notional composition, and is constituted by the laser oscillation machine 60, the reflecting mirror 61, the 1st scanning mirror 62, the 2nd scanning mirror 63, and the image formation lens 64. It is reflected one by one in a reflecting mirror 61, the 1st scanning mirror 62, and the 2nd scanning mirror 63, and the laser beam 65 by which outgoing radiation was carried out from the laser oscillation machine 60 penetrates the image formation lens 64, and connects a focus to the front face of a package 3. The aforementioned 1st scanning mirror 62 has structure by which a roll control is carried out by the 1st scanning motor 66. Moreover, the aforementioned 2nd scanning mirror 63 has structure by which a roll control is carried out by the 2nd scanning motor 67. The axis f rotation of the aforementioned 1st scanning mirror 62

and the axis of rotation of the aforementioned 2nd scanning mirror 63 can intersect perpendicularly, can move freely the laser beam 65 which reaches 1st scanning motor 66 and connects a focus to the front face of a package 3 by control of the 2nd scanning motor 67, and can draw a character etc. This can perform marking.

[0046] Although smoke, soot, etc. also generate laser marking by this scanning method in the irradiation portion of a laser beam 65, since this smoke, soot, etc. are blown away by the air 47 injected from the gas jet nozzle 40 in an instant and are exhausted from the exhaust 41, smoke, soot, etc. stop serving as an obstruction of a laser beam 65, defluxion or the chip of a character do not occur but exact printing of them is attained.

[0047] Moreover, although the aforementioned operation gestalt explained the example which prepared a gas jet nozzle and the exhaust, it considers only as a gas jet nozzle and the exhaust is good also as structure which is not installed. That is, since an always pure gas is sprayed on a marking field from the aforementioned gas jet nozzle, smoke, soot, etc. which are generated at the time of marking are eliminated from a marking field in an instant, it stops occurring and always exact marking of the fall of the optical intensity of the laser beam for marking becomes possible. Especially smoke, soot, etc. that were eliminated from the marking field in the case of the laser mark equipment installed in a clean room are promptly removed from a workspace by operation of a clean room, and stop causing trouble to work by it.

[0048] Moreover, other gases, such as nitrogen gas, are sufficient as the gas injected from a gas jet nozzle.

[0049] Although the above explanation explained the case where invention mainly made by this invention person was applied to the laser marking technology used as the background which is a field of the invention, it is not limited to it.

[0050] this invention is applicable to the laser-beam-machining technology of generating smoke, soot, etc. at least.

[0051]

[Effect of the Invention] It will be as follows if the effect acquired by the typical thing among invention indicated in this application is explained briefly.

[0052] (1) In the laser mark equipment which chooses the font of a mask one by one and carries out marking one by one, and the laser mark equipment by the scanning method, although smoke, soot, etc. are generated from a laser beam irradiation portion Since this smoke, soot, etc. are attracted and exhausted by the exhaust while they are blown away by the air injected towards a marking field from a gas jet nozzle in an instant, the defluxion and the chip of a character from which the aforementioned smoke, soot, etc. serve as an obstruction stop occurring, and they can carry out marking of the mark correctly. Therefore, reduction of a marking cost can be attained.

[Translation done.]